CLAIMS

What is claimed is:

1. An apparatus, comprising:

a semiconductor material;

an optical path through the semiconductor material, the optical path optically coupled to receive an optical beam, the optical beam including one or more wavelengths; and

a nonlinearly chirped Bragg grating disposed in the semiconductor material, the optical path including the nonlinearly chirped Bragg grating to substantially reduce chromatic dispersion in the optical beam.

2. The apparatus of claim 1 wherein the nonlinearly chirped Bragg grating includes a plurality of perturbations of a refractive index in the semiconductor material along the optical path.

3. The apparatus of claim 2 wherein the plurality of perturbations of the refractive index are provided with regions of silicon and polysilicon disposed in the semiconductor material with nonlinear periodicity along the optical path.

4. The apparatus of claim 3 further comprising an adjustable heater disposed proximate to the nonlinearly chirped Bragg grating to adjust a temperature along the nonlinearly chirped Bragg grating, wherein an effective index of refraction along the optical path is responsive to the temperature along the nonlinearly chirped Bragg grating.

5. The apparatus of claim 2 wherein the plurality of perturbations of the refractive index are provided with periodic regions of silicon and polysilicon disposed in the semiconductor material along the optical path, the apparatus further including a plurality of adjustable heaters disposed proximate to the nonlinearly chirped Bragg grating to adjust a nonlinear temperature gradient in the semiconductor material along the optical path, wherein an effective index of refraction along the optical path is responsive to the nonlinear temperature gradient along the nonlinearly chirped Bragg grating.

6. The apparatus of claim 2 wherein the nonlinearly chirped Bragg grating includes a plurality of charge-modulated regions disposed in the semiconductor material along the optical path, the plurality of charge modulated regions provided with a plurality of insulated electrodes distributed along the optical path.

7. The apparatus of claim 6 wherein adjustable voltages are coupled across the plurality of insulated electrodes with a nonlinear voltage gradient across the plurality of insulated electrodes.

8. The apparatus of claim 6 wherein an effective index of refraction along the optical path is responsive to adjustable voltages coupled across the plurality of insulated electrodes.

9. The apparatus of claim 6 wherein spacing between the plurality of insulated electrodes in the semiconductor material along the optical path has nonlinear periodicity.

10. The apparatus of claim 1 further comprising a waveguide disposed in the semiconductor material, the waveguide including the optical path and the nonlinearly chirped Bragg grating.

11. The apparatus of claim 10 wherein the waveguide comprises a rib waveguide disposed in the semiconductor material.

12. The apparatus of claim 1 wherein the optical beam includes said one or more optical channels centered in wavelength bands located at approximately 1310 or 1550 nanometers.

13. A method, comprising:

directing an optical beam through a semiconductor material and to a nonlinearly chirped Bragg grating disposed in the semiconductor material;

reflecting portions of the optical beam matching a Bragg condition of the nonlinearly chirped Bragg grating to provide a first chromatic dispersion to the optical beam; and

adjusting the Bragg condition of the nonlinearly chirped Bragg grating to adjust the first chromatic dispersion provided to the optical beam.

14. The method of claim 13 further comprising substantially negating effects of a second chromatic dispersion introduced to the optical beam, wherein said first chromatic dispersion is of opposite sign and substantially equal to said second chromatic dispersion, said negating effects of said second chromatic dispersion introduced to the optical beam

comprising said reflecting portions of the optical beam matching the Bragg condition of the sampled nonlinearly chirped Bragg grating.

15. The method of claim 13 wherein said adjusting the Bragg condition of the nonlinearly chirped Bragg grating comprises adjusting an effective refractive index in the semiconductor material along an optical path of the sampled nonlinearly chirped Bragg grating.

16. The method of claim 15 wherein said adjusting the effective refractive index in the semiconductor material along the optical path of the nonlinearly chirped Bragg grating comprises adjusting a temperature of the semiconductor material including the sampled nonlinearly chirped Bragg grating.

17. The method of claim 16 wherein said adjusting the temperature of the semiconductor material including the nonlinearly chirped Bragg grating includes adjusting the temperature of the semiconductor material to have a nonlinear temperature gradient along the optical path of the sampled nonlinearly chirped Bragg grating.

18. The method of claim 16 wherein said adjusting the temperature of the semiconductor material including the nonlinearly chirped Bragg grating includes adjusting the temperature of the semiconductor material to have a uniform temperature along the optical path of the sampled nonlinearly chirped Bragg grating, the nonlinearly chirped Bragg grating including regions of silicon and polysilicon disposed in the semiconductor material

with nonlinear periodicity along the optical path of the sampled nonlinearly chirped Bragg grating.

19. The method of claim 15 wherein said adjusting the effective refractive index in the semiconductor material along the optical path of the nonlinearly chirped Bragg grating comprises adjusting a concentration of charge in each of a plurality of charge modulated regions disposed in the semiconductor material along the optical path, the plurality of charge modulated regions provided with a plurality of insulated electrodes distributed along the optical path.

20. The method of claim 19 wherein said adjusting the concentration of charge in each of the plurality of charge modulated regions in the semiconductor material along the optical path includes coupling adjustable voltages across the plurality of insulated electrodes with a nonlinear voltage gradient across the plurality of insulated electrodes.

21. The method of claim 19 wherein said adjusting the concentration of charge in each of the plurality of charge modulated regions in the semiconductor material along the optical path includes coupling adjustable voltages across the plurality of insulated electrodes with a uniform voltage across the plurality of insulated electrodes, the plurality of insulated electrodes distributed in the semiconductor material along the optical path with nonlinear periodicity.

22. The method of claim 14 wherein the optical beam includes a plurality wavelengths, wherein said negating the effects of the second chromatic dispersion introduced

to the optical beam comprises negating the effects of the second chromatic dispersion introduced to each of the plurality of wavelengths included in the optical beam.

23. The method of claim 13 wherein the optical beam includes a plurality wavelengths, the method further comprising selecting at least one of the plurality of wavelengths to negate the effects of the second chromatic dispersion introduced to the selected wavelength included in the optical beam, wherein the adjusting of the Bragg condition of the nonlinearly chirped Bragg grating is in response to the selected wavelength included in the optical beam.

24. The method of claim 14 wherein the effects of the second chromatic dispersion in the optical beam are introduced prior to said directing the optical beam through the semiconductor material and to the nonlinearly chirped Bragg grating disposed in the semiconductor material.

25. The method of claim 14 wherein the effects of the second chromatic dispersion in the optical beam are introduced after said directing the optical beam through the semiconductor material and to the nonlinearly chirped Bragg grating disposed in the semiconductor material.

26. A system, comprising:

a first optical device to transmit an optical beam;

a second optical device optically coupled to receive the optical beam from the first optical device; and

a tunable dispersion compensation device optically coupled between the first and second optical devices, the optical beam directed from the first optical device through an optical fiber and to the tunable chromatic dispersion compensation device to the second optical device, the tunable dispersion compensation device including:

a semiconductor material;

an optical path through the semiconductor material, the optical optically coupled to receive the optical beam; and

a nonlinearly chirped Bragg grating disposed in the semiconductor material along the optical path, the nonlinearly chirped Bragg grating having a tunable Bragg condition, the nonlinearly chirped Bragg grating optically coupled to reflect the optical beam with reduced chromatic dispersion in the reflected optical beam.

27. The system of claim 26 wherein the nonlinearly chirped Bragg grating includes regions of silicon and polysilicon disposed in the semiconductor material with nonlinear periodicity along the optical path.

28. The system of claim 26 wherein the tunable dispersion compensation device includes a heater disposed proximate to the semiconductor material to adjust a temperature of the semiconductor material of the nonlinearly chirped Bragg grating to adjust an effective refractive index along the sampled nonlinearly chirped Bragg grating.

29. The system of claim 28 wherein the tunable dispersion compensation device includes a plurality of charge modulated regions disposed in the semiconductor material

along the optical path, the plurality of charge modulated regions provided with a plurality of insulated electrodes distributed along the optical path.

30. The system of claim 29 wherein adjustable voltages are coupled across the plurality of insulated electrodes with a nonlinear voltage gradient across the plurality of insulated electrodes.

31. The system of claim 29 wherein adjustable voltages are coupled across the plurality of insulated electrodes and wherein the plurality of insulated electrodes are distributed in the semiconductor material along the optical path with nonlinear periodicity.